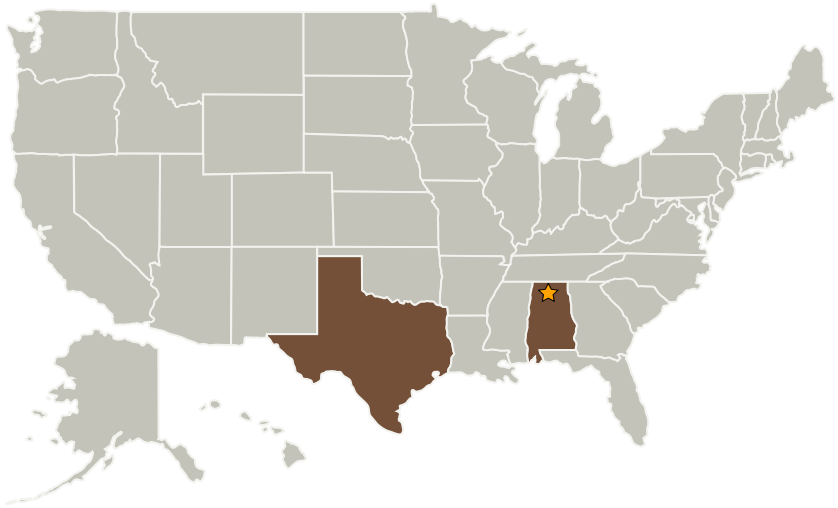
Multifunctional Carbon Nanotube/Polyethylene Complex Composites for Space Radiation Shielding, Phase I

Completed Technology Project (2005 - 2005)

Project Introduction

Polyethylene (PE), due to its high hydrogen content relative to its weight, has been identified by NASA as a promising radiation shielding material against galactic cosmic rays and solar energetic particles. Carbon nanotubes (CNTs), due to their small diameter, high-mechanical strength, and high-electrical and thermal conductivity, are recognized as the ultimate carbon fibers for high performance, multifunctional composites. Prior studies failed to produce the CNT/polymer composites that fully exploit nanotubes' outstanding mechanical, electrical and thermal properties because of poor dispersion of nanotubes in polymer matrices and poor adhesion between nanotubes and the polymer matrix,. Zyvex has developed a versatile and non-damaging chemical platform that allows us to engineer specific nanotube surface properties to permit homogeneous dispersion of nanotubes in various solvents and polymer matrices, and enables the significantly enhanced adhesion between nanotubes and the polymer matrix. The major innovation of our technical approach is to marry these two outstanding materials using Zyvex's chemical platform technology to produce a novel CNT/PE complex composite that not only has high radiation shielding performance, but also has high mechanical strength, high electrical conductivity, and improved thermal stability. Multifunctional CNT/PE complex composite will find broad applications in shielding humans in spacecrafts and habitats.

Primary U.S. Work Locations and Key Partners



Multifunctional Carbon Nanotube/Polyethylene Complex Composites for Space Radiation Shielding, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Small Business Innovation Research/Small Business Tech Transfer

Multifunctional Carbon Nanotube/Polyethylene Complex Composites for Space Radiation Shielding, Phase I

Completed Technology Project (2005 - 2005)

Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
ZYVEX Corporation	Supporting Organization	Industry	Richardson, Texas

Primary U.S. Work Locations	
Alabama	Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.1 Materials
    - TX12.1.1 Lightweight Structural Materials